REMARKS

Claim 1 is amended with the limitations of claims 6 and 11, with a limitation from claim 5, and the clarifying connection between the "image" of claim 1 and the two-dimensional images of limitations from claim 11. No new matter is believed to have been added thereby. No new search is required. Claims 6 and 11 are cancelled. Claims 7, 8, and 12 are amended to alter dependency due to the amendments to claim 1. Claims 1-5, 7-10, 12-15 and 23-25 are pending. Applicants respectfully request reconsideration of the rejections of claims despite finality, including independent claim 1.

In the Office Action, the Examiner rejected claims 1-6, and 23-25 pursuant to 35 U.S.C. § 103(a) as unpatentable over Hossack, et al. (U.S. Patent No. 6,083,168) in view of Oshio, et al. (U.S. Patent No. 6,684,098). Claims 7-13 were rejected pursuant to 35 U.S.C. § 103(a) as unpatentable over Hossack, et al., in view of Oshio, et al. and further in view of Sumanaweera, et al. (U.S. Patent No. 5,967,987). Claims 14 and 15 were rejected pursuant to 35 U.S.C. § 103(a) as unpatentable over Hossack, et al. and Oshio, et al. in view of Melton, Jr., et al. (U.S. Patent No. 5,373,848).

Independent claim 1 recites tracking motion within a region inside a patient, the tracking being with scan data representing the region inside the patient and comprising tracking the motion within the region, the region being a three-dimensional volume, and automatically altering an acquisition scan plane position relative to a transducer as a function of the motion, the acquisition scan plane position being for acquiring subsequent scan data with a same scanner used for tracking the motion and comprising adaptively altering the acquisition scan plane position in response to the motion, relative to the transducer, at a region of interest within the three-dimensional volume over time, wherein the transducer comprises a multi-dimensional array of elements, subsequently scanning at the adaptively altered acquisition scan plane position, and generating the image as two-dimensional images. Hossack, et al., Oshio, et al.,

and Sumanaweera, et al. do not disclose tracking, with scan data, motion in a 3D volume and altering a two-dimensional imaging scan plane position for generating 2D images.

Sumanaweera, et al. move the transducer to determine flow in a different plane (col. 8, lines 6-18). The scan plane is at the same orientation to the transducer. Sumanaweera, et al. move the transducer to scan different planes of a same vessel region for volume flow. Sumanaweera, et al. do not track motion in 3D for altering a 2D image plane relative to a transducer for 2D imaging.

Hossack, et al. use different imaging parameters within a two-dimensional region of interest (abstract; Figure 5; and col. 3, lines 7-12 and 33-45). The apparent frame rate may be increased by interpolating extra frames for the region of interest using motion compensation (col. 14, lines 45-56). For three-dimensional imaging where the frame rate will be very slow, the apparent frame rate may be increased by interpolation within a region of interest (col. 16, lines 44-47). Hossack, et al. do not alter scan plane position, but instead track to allow interpolation for frame rate in 2D or 3D data. Hossack, et al. do not track motion in 3D for altering a 2D image plane relative to a transducer for 2D imaging.

Oshio, et al. align a machine coordinate system (MCS) with a personal coordinate system (PCS)(col. 4, lines 42-49). The alignment uses a stereotactic device worn by the user, such as on their head (col. 4, lines 35-41; col. 8, lines 20-28; and Figure 1). The stereotactic device is non-invasive (col. 4, lines 8-13; and col. 7, line 55-col. 8, line 2). For real-time imaging slice correction, a video camera is used to determine the location and orientation of the user-worn, stereotactic device (col. 21, lines 10-19). If the patient's head moves during a magnetic resonance (MR) scan, the MR scanning plane may be aligned to the head (col. 21, lines 20-25). Oshio, et al. use video to detect position (location and orientation) of a worn device and align an MR scan plane to a patient oriented coordinate system.

Oshio, et al. do not track motion and alter the acquisition scan plane position as a function of the motion. Oshio, et al. use an absolute position. Due to motion, the absolute position changes. However, it is the position that determines the acquisition scan plane position, not the change in position. The change in position (motion) is not used to alter the acquisition scan plane position. For example, Oshio, et al. do not use a difference in position or change to alter the acquisition scan plane position. Instead, Oshio, et al. use the current head

position to determine the acquisition scan plane position. The "imaging plane can be aligned to the head" to compensate for the motion (col. 21, lines 23-25). If the head is now in a position, the scan plane is located at this position, but the motion of the head is not used to alter the position. Oshio, et al. do not track motion in 3D for altering a 2D image plane relative to a transducer for 2D imaging.

Hossack, et al. provide for 2D or 3D tracking. In both cases, the tracking is used to interpolate extra datasets, not for altering a 2D image plane relative to a transducer for 2D imaging. Oshio, et al. provides for altering coordinate and corresponding scan positions to match the patient orientation. This absolute position or coordinate determination of Oshio, et al. does not use motion tracking to alter the imaging plane. Both Hossack, et al. and Oshio, et al. fail to use motion tracking to alter scan plane position relative to a transducer.

Claim 1 is allowable for another reason. A person of ordinary skill in the art would not have used the scan plane position of Oshio, et al. with the motion compensation of Hossack, et al. The cited portions of Hossack, et al. rely on scan data correlation for tracking (col. 15, lines 7-16). However, Oshio, et al. rely on LEDs on an external device and a camera for dynamic correction of the scan plane (col. 21, lines 10-25). The use of anatomical landmarks or scan data is discouraged (col. 1, lines 51-59). Instead, Oshio, et al. teach that a worn device independent of the imaging machine scan is more optimal (col. 3, lines 17-19; and col. 4, lines 5-8). Oshio, et al. discourage use of scan data, instead indicating use of a device for coordinate alignment. A person of ordinary skill in the art would not have used the scan data tracking of Hossack, et al. with the scan plane positioning of Oshio, et al. since Oshio, et al. teach away from use of scan data tracking, instead relying on a worn device. A person of ordinary skill in the art would have used a worn device of Oshio, et al., not the scan data tracking of Hossack, et al.

Claim 1 includes the maintaining limitation from claim 5. The Examiner relied on Hossack, et al. to show this limitation. Hossack, et al. designate a region of interest, but do not alter scan plane position to maintain the plane at the region of interest. Hossack, et al. assume the scan plane is always at the region of interest.

Claim 1 is allowable for another reason. The adaptive alteration limitations from claim 11 are not taught by Sumanaweera, et al. The Examiner relies on Sumanaweera, et al. for

movement of the transducer, resulting in scan plane movement. However, this movement of Sumanaweera, et al. is to gather information for volume flow determination. The transducer is not moved to adaptively alter the scan plane position in response to motion.

Claim 1 is allowable for yet another reason. Hossack, et al. do not enable altering a scan plane position relative to a multi-dimensional transducer. The Examiner cites to Hossack, et al. for this limitation. However, Hossack, et al. teach a volume scan and tracking motion to interpolate temporally. Hossack, et al. do not disclose how to alter a scan plane position relative to the multi-dimensional array of elements. Oshio, et al. is directed to MR imaging, so does not teach how to alter the scan plane position relative to an array of elements. Sumanaweera, et al. provide for transducer motion to change scan plane position, not altering the scan plane position relative to the transducer.

Dependent claims 2-5, 7-10, 12-15, and 23-25 are allowable for at least the same reasons as independent claim 1. Further limitations patentably distinguish from the cited references.

Claim 9 recites tracking by comparing data responsive to transmitting to at least three sub-regions with data responsive to scanning a representative sample. Sumanaweera, et al. determine volume flow for different planes, and do not compare data responsive to sub-regions with a representative sample.

Claim 10 recites transmitting grouped sets of beams spaced apart in a volume for tracking a given motion. Sumanaweera, et al. scan the same plane from different directions and with wide and narrow beams. Motion is determined for each scan, not based on grouped sets of spaced apart beams. Sumanaweera, et al. are concerned with the flow and scan accordingly. A person of ordinary skill in the art would not track motion from spaced apart sets of beams since this would not work to determine the flow information desired by Sumanaweera, et al.

Claim 12 recites shifting two-dimensional images as a function of an initial position of an ROI. Sumanaweera, et al. scan convert to alter from the acquisition polar coordinate format to the display Cartesian coordinate format. This scan conversion does not provide for shifting images as a function of an initial position of an ROI.

Claim 14 recites tracking one of speckle and a spatial gradient. The Office Action relies on Melton, Jr. for this limitation. Melton, Jr. et al. state “this means that the volume is

symmetric with respect to the spatial gradient along any axis that passes through its center (not just the x-y-z system shown in the figures)." This is not related to tracking motion using a spatial gradient as required by claim 14. Melton, Jr. merely mentions the term "spatial gradient," and does not teach tracking one of a speckle and spatial gradient.

A person of ordinary skill in the art would not have used the teachings of Melton, Jr. with Oshio, et al. Melton, Jr. et al. are unrelated to Oshio, et al., such as being for different types of imaging over different spatial distributions. Therefore, Melton, Jr et al. should be considered nonanalogous art, and the rejection of claims 14 and 15 should be withdrawn, according to M.P.E.P. §2141.01(a).

Claim 23 requires obtaining data for motion tracking in response to different acquisition parameters than used for imaging. Hossack, et al. determine motion from image data, so do not obtain data for motion tracking in response to different acquisition parameters than used for imaging.

Claim 24 requires automatically altering an acquisition volume position relative to a transducer as a function of the motion. Hossack, et al. scan a plane or volume, but do not provide for changes in the scan plane position relative to the transducer. Oshio, et al. alter plane position, not volume relative to a transducer.

CONCLUSION:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof.

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